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ABSTRACT

This paper discusses the development of structuralism in psychology, linguistics, mathematics, philosophy, anthropology, and sociology by citing theories supported by thinkers in all these fields. The contrast between structure (schema, pattern, gestalt) and function (activity, interaction, transformation) is used as the point of departure for the discussion. The author seeks to emphasize the mutual dependency of these two concepts as seen in more recent theories. Piaget's theories concerning development are discussed at length. Concluding remarks review the trends and options of modern psychology. (VM)

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INTRODUCTION TO DEVELOPMENTAL AND HISTORICAL STRUCTURALISM

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Introduction to Developmental and Historical Structuralism

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The following essay introduces structuralism from several different angles. In the first section of this introduction, the concept of structure (and in extension those of schema, pattern, gestalt, etc.) will be contrasted with that of function (and in extension those of activity, interaction, transformation, etc.). Such a comparison will not merely reconfirm the old dichotomy as introduced into psychology by James and Titchner, but will emphasize the mutual dependency of structure and functions. In this attempt we rely on Piaget's interpretations and, thus, emphasize genetic aspects. Reference will also be given to recent trends in linguistics, especially to Chomsky's transformational grammar.

In the second section, we trace the origin of these ideas to some reformulations in mathematics proposed during the second half of the 19th century by Dedekind, Frege, Russell and others. The new emphasis stressed the analysis of relational orders and classes and thus contributed to the foundation for structural interpretations.

Further steps in this direction were taken in Carnap's early work, which is represented in the third section. Carnap provides explicit descriptions of structural interpretations, by relying on some positivists of the late 19th century, especially Mach, Poincaré and Avenarius, whose contributions--unfortunately--have frequently been viewed in clear antithesis to structural descriptions. Carnap's interpretations come closest to those held by Avenarius; Mach relates to the psychologism of Wundt, and Poincaré to the early positivism

of Comte. Poincaré, in turn, influences the school of French sociology with Dürkheim, Mauss, Blondel, Halbwachs, and Levy-Brühl, which finally leads to the structural anthropology of Levi-Strauss and to the genetic structuralism of Piaget.

In the fourth section we question, in alliance with modern sociologists and anthropologists, the role of the psychic self as a primary base of knowledge and of psychology as an independent science. Piaget has been criticized for viewing development as emerging, essentially, from within the individual and for failing to give equally strong emphasis to the interactive changes of the socio-historical conditions. Rubinstejn's theory, with which we conclude our presentation, proposed such a dialectic interpretation of a changing organism in a changing world.

Psychology and Linguistics

Early Structuralism

The distinction between structure and function gained its directive influence upon psychology through Titchner. Although previously discussed by James (1890) (see also Ruckmick, 1911), Titchner (1898) elaborated this distinction in detail and thereby, paradoxically, helped his adversaries in founding functionalism in America (Boring, 1957, p. 555). Titchner, by drawing an analogy from biology, proposed a threefold distinction.

> We may enquire into the structure of an organism, without regard to function--by analysis determining its component parts, and by synthesis exhibiting the mode of its formation from the parts. Or we may enquire into the function of the various structures which our analysis has revealed, and into the manner of their interrelation as functional organs. Or, again, we may enquire into the changes of form and function that accompany the persistence of the organism in time, the phenomena of growth and of decay. Biology, the science of living things, comprises the three mutually interdependent sciences of morphology, physiology, and ontogeny [1898, p. 449].

Titchner delineates this distinction not only in regard to the individual organism but also in regard to the species, the "collective life." He continues:

> Corresponding to morphology, we have taxonomy or systematic zoology, the science of classification. The whole world of living things is here the organism, and species and sub-species and races are its parts. Corresponding to physiology, we have that department of biology--it has been termed "oecology"--which deals with questions of geographical distribution, of the function of species in the general economy of nature. Corresponding to ontogeny we have the science of phylogeny: the biology of evolution, with its problems of descent and of transmission [1898, p. 449].

Titchner's contrastive description of structuralism and functionalism (under exclusion of the third major possibility for scientific psychology, geneticism) has had a formative influence upon the development of American psychology or, at least, for its historical description (especially through Boring's work, 1957). Nevertheless, his view of structure, being atomistic and mechanistic, was an exceptionally unfortunate choice. More appropriately, his approach ought to be called the "psychology of content," a denotation commonly reserved for Wundt in distinction to the "psychology of act" by Brentano. Titchner's structuralism emphasizes the analytic identification of psychic constituents (sensations, ideas and emotions). Organizational aspects enter into the discussion only secondarily.

Gestalt Psychology

Structural considerations were firmly introduced into psychology by the Gestalt movement of Wertheimer, Köhler and Koffka. Here, organized patterns become the foundation of scientific inquiries as well as of the phenomenal experience of subjects. The identification of constituent elements attains

negligible importance if any importance at all. As for Titchner, genetic aspects remain neglected. Gestalt psychologists analyze psychic conditions from an "a-historical" point of view. They are concerned, however, with functional aspects which, as introduced by the forerunner of Gestalt psychology, von Ehrenfels (1890), are implied in the so-called "second law of Gestalt."

As commonly expressed, the "first law" states that a Gestalt is more than the sum of its parts, i.e., organizational, structural properties are implied. The "second law" concerns transpositions or transformations through which all parts may lose their absolute positions, though the structural properties are retained, i.e., are kept invariant. Convincing cases of the "second law" are the transpositions of a melody into different keys, or in a more general sense (i.e., keeping fewer properties invariant), the variations upon a musical theme. In regard to spatio-visual conditions, the perception of a simple object, e.g., a suspended triangle, is subject to ceaseless transformations. Not only does the location, illumination and color of the object change relative to the observer, but also the sensory organs of the observer himself undergo ceaseless transformations produced by their gross and fine movements. Thus, the scientific exploration of perceived patterns is as much an abstraction from the ongoing physical and psychic activities as was the abstraction of constituent elements from these patterns by the pre-Gestalt psychologists. What underlies both these abstractions, and therefore ought to be of main interest to the psychologist, are ceaseless sequences of transformations.

Gestalt psychologists recognized this issue, especially through their investigation of the phi-phenomenon. The phi-phenomenon is produced by

switching two light sources on and off. Dependent upon the rate of switching, the lights are either perceived as alternating discrete stimuli, as two continuously lighted stimuli, or as a connecting lighted line. These investigations have primarily been used in refutation of earlier atomistic viewpoints in that they question the identifiability of discrete sensory elements. They could be used equally well to criticize the preponderance of stimulus patterns. The investigations of the phi-phenomenon clearly support a transformational or transactional interpretation. The opposite dominated, however, through Köhler's (1920) analysis of the isomorphism between external physical and internal neurophysiological patterns with its implied priority of the former in the tradition of philosophical realism. A convincing argument for transposition as the key principle has been published by Witte (1960). More recently, Henle (1972) has thoroughly reviewed Wolfgang Köhler's contributions to this discussion.

Cognitive Developmental Psychology

Among present-day psychologists, only Piaget (1970) has drawn a conclusion similar to the transformationists, and has, thereby, reversed the order of the laws of Gestalt psychology. The "law of transposition," now, gains priority over the "law of the Gestalt." As an organism engages physiologically and psychologically in ceaseless transformations, it attains patterns during its internal transitions and attends to patterns as transitional conditions. These patterns represent momentarily objectified states of equilibrium, the organism moves forward through a stream of transactions. In his considerations, Piaget is willing to conclude that "transformations may be disengaged from the objects subject to such transformation and the group defined solely in terms of the set of transformations [Piaget, 1970, pp. 23-24]."

Piaget is, of course, best known for his "stage theory" in which he proposes a fixed sequence of synchronic structures for the characterization of developmental progression. If we take the above quotation seriously, however, development should be characterized by groups of permissible transformations rather than by fixed forms or schemata. Such a notion implies that the freedom of transformation is never unlimited. In regard to mathematical systems, e.g., measurement scales, it implies that basic properties have to be kept "invariant," e.g., in metric systems the relative distances between points. In Piaget's theory of cognitive development, conditions of invariance are represented as temporary states of equilibrium from which the individual will constantly divert, but to which he will always return.

With this emphasis on transformational processes Piaget, at the same time, inverts the meaning of structure and function as originally conceived by Titchner. Now structures emerge through continuous transformational activities; they are, in other words, determined by functions. Moreover, structures emerge from within, whereas for Gestalt psychologists they originate from without. In further contrast to these and to most other structuralists, Piaget relates both the concepts of structure and function to genetic interpretations. Structures do not only emerge through transformations but are subjected to continuous changes. The individual's development is characterized by shifts in structures brought about by transformational activities. Thus, Piaget relates all three aspects of Titchner's outline to one another; his theory is structural, functional, and genetic. Development is not characterized any longer as a sequence of synchronic schemata, but by diachronic clusters of transformations.

Linguistics

Piaget's emphasis upon the connection between structures and transformations directs our attention to some recent developments in linguistics. More distinctly than in psychology, two major schools in linguistics have been called "structuralists" and "transformationists." The former adopted the methodology of the behaviorists in order to determine the major form classes and their arrangements in the natural language. With their emphasis upon methodological rigor, they share with the behaviorists a disrespect for any notions about underlying organizations, forces or meanings. They initiate their inquiries from and on the surface of the linguistic corpus. Quite paradoxically, of course, the denotation of these linguists as "structuralists" cannot be transferred to their allies, the "behaviorists," who, from Titchner's point of view, were regarded as "functionalists." He reserved the label of "structuralism" for his own school of introspective elementarism.

Structuralism, as proposed by Bloomfield (1933), dominated American linguistics for many decades. Although objections were expressed repeatedly--for instance, Jesperson (1937) claimed that the purpose of a linguistic analysis is "to denote all the most important interrelations of words and parts of words in connected speech . . . . Forms as such have no place in the system [1937, pp. 13 and 104]"--a major revision was not undertaken until the appearance of Chomsky's transformational grammar.

As for Piaget, Chomsky's (1957, 1959) publications reveal some major changes in his own thinking. He started out with describing alternative models of syntactic structures (1957) and by polemizing against behavioristic

interpretations (1959). Then he elaborated his syntactic theory (Chomsky, 1965, 1968) which is of primary interest for our present discussion. His most recent interpretations, nevertheless, are not as radical as those by Piaget (1970). In contrast to Piaget's transformationism, Chomsky argues at two distinct levels: for grammars of the surface structures of the natural languages and for an underlying universal deep structure. Most of his efforts are directed toward the delineation of the latter. As this is achieved, attention can shift toward the specification of transformation rules by which the former are derived from the latter. Transformations are thus performed upon given structures and do not attain the priority that Piaget is willing to assign to them. Instead of considering these transformations as the universal basis, they merely operate upon the deep structure to which such a priority is assigned. Not surprisingly, therefore, some of his followers (Lenneberg, 1967; McNeill, 1968, 1970) have identified these universal forms of the deep structure with innate schemata of the organisms, and thus have revitalized the nativism of 19th century psychology. What needs to be done is to relate the transformations to intrinsic activities of the organism but not to their forms.

The concept of "transformation," as used by modern linguists, creates as many difficulties as the concept of "structure" as used by Titchner. Transformations have their well-defined place in the logic and mathematics of numerical systems. As first elaborated by Hölder (1901) and discussed in many different treatises in the behavioral and social sciences (see Stevens, 1951; Coombs, 1964) measurements can be based upon numerical systems of varying complexity, i.e., upon cardinal, ordinal, rational systems, etc.

As their complexity increases (and with it the number of operative prerequisites that have to be fulfilled), the complexity of the transformations that can be imposed upon these systems decreases. Thus cardinal numbers can be subjected to a wide range of transformations, rational numbers only to a few. In other words, with increasing complexity, larger sets of properties have to be kept invariant unless the structure of the whole system is to be invalidated.

Whereas the structure of these numerical systems and their sets of permissible transformations can be specified with precision, the use of the latter term in linguistics is rather ambiguous. Linguistic transformations do not only change the order of items within strings but also basic features of expressions--for example, they change declarative statements into negatives, questions, passives, and vice versa. Since the dimensions of linguistic expressions are difficult to determine and vary from investigation to investigation, linguistic transformations also lack descriptive rigor. In particular, the invariant properties are not spelled out. Indeed, mathematicians seem to emphasize the invariances; linguists point to the modifications brought about by transformations.

Mathematics

Theories of Numbers

In discussing some reformulations in mathematical thinking which contributed to the development of modern structuralism, we direct our attention to the work of Cassirer (1910). As implied in the German title of his book, The Concepts of Substance and Functions, early philosophizing relied heavily

upon the concept of smallest, substantive elements. With the objective basis of these particles taken for granted, the task for philosophy and sciences consisted in analyzing the systematic connections between them. In opposition to such conceptualizations, Cassirer argues for the priority of functional relations or operations, a switch in thinking which characterizes structural interpretations. This shift in conceptualization also occurred in mathematics.

During the early historical periods, at least up to Descartes, mathematics was seen as a reflection of or an ideal abstraction from the real world with its substantial particle properties. A major reformulation was brought about by Leibniz for whom the basis of knowledge did not lie in the reflection and abstraction of ideas themselves but in the relationship between ideas. As a general example of this change in thinking consider the notion of geometrical points and lines. Traditionally, points were taken for granted and, thereafter, notions about their shortest connections, i.e., through straight lines, were derived. Thus, the solution was achieved through operations performed upon these points. Similarly in algebra, the natural numbers, as experienced by counting real objects, were taken for granted. Whenever problems arose, e.g., when a larger number was to be subtracted from a smaller one, extensions of the system were introduced, in this case, an extension into the domain of negative numbers. In many other cases, new numbers were interspersed between the natural numbers, such as fractional, irrational, and imaginary numbers. Thereby, the notions of the infinity in extension and in partition of the domain of numbers emerged. But at the same time, it became even more apparent that the prerequisites, which made these developments possible, lie in our full use of operative capabilities rather than in better and better

approximations of the range of real objects. In other words, mathematics began to be seen as a system of operations rather than as a reflection of substantive conglomerates. Since the full range of these operations has been hardly explored, many new forms of mathematics could emerge. Developments since the second half of the 19th century have confirmed this possibility, leading to non-Euclidean geometries and to some of the number systems mentioned above.

Related to these developments are changes in the concepts of time and space (Cohen, 1972; Riegel, 1972c). Traditionally, time had been regarded as finite and discrete; thus, the concept of time was similar to the concept of substance. As the natural number system was extended and as the slots between numbers were filled to a greater and greater extent, the notion of infinity was introduced through induction. Now, instead of emphasizing the periodicity of time, its beginning and its end, an abstract continuum was derived. To Cassirer, however, the question of whether time is discrete or continuous, finite or infinite, relative or absolute depends solely upon the operations selected by the observer and not upon external, nonintellectual criteria.

Cassirer relates our conception of time to the theories of numbers and algebra. Geometry, on the other hand, he relates to the simultaneity and coexistence of several such number systems. Subsequently, also our concept of space can be continuous or discrete, absolute or relative, Euclidean or non-Euclidean. Originally, according to Cassirer, the concept of space was discrete and bound by the three dimensionality of our experience. Through inductive generalizations the notion of a continuous space was derived and

attempts were made to shift from the three dimensions of the experienced space to non-Euclidean interpretations. Although this has been intellectually achieved, Cassirer insists that our conception of space ought not to be regarded as a generalization from objective, substantive conditions of the real world, but rather as a fuller elaboration of our intellectual operations which enable us to generate these notions as well as many others not yet proposed.

Dedekind, Frege, and Russell

Cassirer's views, which occasionally have been called "logical idealism," are shared by the mathematician Dedekind (1893) who argues that our concept of numbers, being a representation of pure laws of thinking, is independent from our conceptions of space and time. Quite to the contrary, only through the logical derivation of a theory of numbers and the attainment of a monotone domain of numbers have we become able to explicate our conceptions of space and time. If, in the pursuit of these explorations, we try "to determine what we are doing when counting a class or a number of things, we are bound to recognize the capability of the mind to relate things to things, to compare one thing with another, or to map one thing upon another; without this capability thought would not be possible at all [Dedekind, 1893, pp. III-IV, author's translation]."

According to Dedekind, our basic conception of numbers is relational. Through implicit mental comparisons we derive ordinal numbers. By explication we become able to categorize numbers or items. For example, we might, within a given range, group all those items into a class which are below a certain value a. Items above that value are assigned to a different class.

Following this procedure (the well-known Dedekind "incision"), the criterion itself, a, cannot belong to either of the two classes which it defines. Therefore, we need to elaborate other operations that will lead to a new numerical system and include the criterion a, i.e., the system of irrational numbers. By applying these deductive procedures step by step and thereby extending the domain of numbers encompassed, Dedekind and the following generation of mathematicians succeeded in deriving the whole field of mathematics from this basis.

For this purpose it was first necessary to deduce the system of ordinal numbers. This was done by applying Dedekind's procedure repeatedly, thus generating the classes A and B, on the one hand, and C and D on the other. If there is an element which belongs to the class A of the first incision and to the class D of the second incision, then we would call the first categorization larger and let it follow the second one in a sequence. Thus, a criterion is given which, when applied repeatedly, generates a completely ordered system of numbers.

Dedekind's procedure is based on ordinal judgments. For the derivation of cardinal numbers and categorizations in general--it has been argued by Frege (1903) and Russell (1903)--judgments of equivalence are more fundamental. Contrary to the traditional conception, according to which numbers are considered as given and, subsequently, judged as equivalent or not, it is the goal of their approach to determine an operation of equivalence first, and then to derive sets of equivalent and nonequivalent numbers on the basis of such an operation. As stated by Frege, "It is our intention to form the content of an operation which can be expressed in an equation in such a way

that there is a number on each side of it . . . . Thus, by means of the familiar concept of equivalence we are to obtain what we have to consider as equal [1903, p. 27]."

In comparing the approach by Dedekind and Cassirer with that by Frege and Russell, their similarities and dialectic interdependencies need to be emphasized. First, both camps rely on relations--the former, in general, on asymmetric relations of different kinds, the latter on the symmetric relation of equivalence. Second, both emphasize operative, constructive aspects through which complex structures are derived. They neither regard these structures nor the equivalences and relations as given in the external world but as founded in the operations of the organism. Thus, their interpretations are closely in line and anticipate Piaget's cognitive developmental theory. They are at variance, however, with sociocultural theories which assign, at least in part, these operative, constructive or transformational activities to society which, in turn, will determine, at least in part, the activities of the individual. Before we discuss these modern trends, a brief overview will be given of some recent philosophical developments which parallel those in mathematical theory. In particular, we will refer to Carnap's (1928) early work.

Philosophy

Positivism and Conventionalism

The philosophical roots of modern structuralism lie in rather unusual grounds which, at first sight, we might not at all connect with such an interpretation. This is due to some common misconceptions about these schools,

especially those of French and German positivism and, to a lesser extent, phenomenologism.

The German positivism of the late 19th century became instrumental and supportive for a scientific psychology of which Titchner was one of the late representatives. Contrary to frequent statements, especially expressed by American writers, positivism of this type was not at all supporting a blind search for "facts" but would argue against the notion of "facts" as a form of evidence independent of the observer and solely determined by external conditions of "nature." To Mach (1886), for example, there were only sensory impressions; all knowledge had to be derived from them and, thus, was in the mind. He strongly supported the "psychologism" of the late 19th century--which epistemologically subordinated all other sciences under psychology--and emphasized, though timidly, the constructive aspects of scientific efforts in maintaining that "facts" are merely theories to which we have become sufficiently accustomed.

Quite similar in orientation, though with much stronger emphasis on the sociocultural basis of knowledge, Poincaré's conventionalism leads us far back in the history of philosophy, at least to Locke's critical realism. The notion of sociolinguistic conventions was introduced in order to account for the agreement between different observers in regard to secondary qualities, i.e., those qualities that do not directly reflect properties of nature (primary qualities) but depend upon the observers' interpretations, such as his impressions of warmth, redness, brightness, etc. Poincaré carries this interpretation to its conclusion by considering all our impressions (not only those representing secondary qualities) as dependent upon sociolinguistic conventions. Each individual has his subjective experiences; in order to

make general knowledge possible, certain agreements have to be reached on how to talk about these impressions. Subsequently, knowledge is not only dependent upon the sensory impressions and observations but upon the constructive efforts on the part of the observers to state their experience in communicable terms.

The last issue receives focused attention in the work of Avenarius (1894/5) who, for the first time, emphasized logical and syntactic organizations as a necessary prerequisite for the acquisition of knowledge. While previously the agreement on communicable concepts was stressed, Avenarius pointed to the need for consensus about logical and linguistic structures. To Avenarius these structures are arbitrarily selected in about the same way in which rules of a game, such as chess, are being set up. There is neither intrinsic nor extrinsic validity in these systems; their value is dependent upon criteria such as internal consistency, simplicity, and comprehensiveness.

Constructivism

Avenarius' interpretations failed to have a major effect upon the philosophy and the execution of the behavioral and social sciences. His ideas gained considerable importance, however, through the extensions by the early Carnap (1928). Accepting the shift from substantive to functional conceptualization (Cassirer, 1910), Carnap elaborated structural interpretations with a strong nominalistic and constructivistic emphasis. He traced his interpretations to Russell's (1903) theory of relations and to the "reduction of 'reality' to the 'given' [1928, p. 7]" as successfully performed by Avenarius, Mach, Poincaré, Külpe, Ziehen, and Driesch. The "givens" have

to be sought in the unmediated, phenomenal experience. Rather than halting at such contemplative state, Carnap asks that out of these experiences constructive steps have to be taken. Knowledge does not so much consist in introspective apprehension but in active construction. At the beginning, he would agree with Cassirer (1910), that it is not the sensory impression but the sentence ("Satz" as related to "setzen," "proposing") which alone generates knowledge by making it communicable, social, and human.

There are two basic components upon which individual and scientific knowledge is based: property description and relation description.

> A property description indicates the properties which the individual objects of a given domain have, while a relation description indicates the relations which hold between these objects, but does not make any assertion about the objects as individuals. Thus, a property description makes individual or, in a sense, absolute, assertions while a relation description makes relative assertions [Carnap, 1967, p. 19].

While the present author would take exception to the notion that property descriptions are nonrelational (see chapter VIII), Carnap's main attention, anyhow, centers around the relation descriptions. Construction of knowledge consists in transforming relation descriptions (which ultimately might have been generated from property descriptions) according to construction rules or constructional definitions.

> ....to construct a out of b, c means to produce a general rule that indicates for each individual case how a statement about a must be transformed in order to yield a statement about b, c [Carnap, 1967, p. 6].

The development of constructivism has been prepared by Poincaré's emphasis that knowledge cannot be based upon the "givens" alone, e.g., sensations, but that "only relations between the sensations have an objective value [Poincaré, 1902, p. 198." For Carnap, this move, although in the right direction, does

not go far enough. Scientific knowledge becomes possible only through the systematic explication of the interrelation of relations, i.e., through the study of structures. Ultimately, all knowledge is structural and is removed and separated from its base, the property descriptions or, in Poincaré's sense, the relations with objective value.

Within a system of structural description, Carnap distinguishes two kinds of definitions: Ostensive definitions and definite descriptions. The former resemble property descriptions but are stated in relational terms.

> Here, "...the object which is meant is brought within the range of perception and is then indicated by an appropriate gesture, e.g., 'That is Mont Blanc'...definite descriptions... list...essential characteristics, but only as many...as are required to recognize unequivocally the object which is meant within the object domain under discussion," e.g., "Mont Blanc indicates the highest mountain in the Alps," or..."the mountain so many kilometers east of Geneva [Carnap, 1928, p. 24]."

While empirical sciences have to incorporate ostensive statements in order to relate to their specialized fields of observations, science will, ultimately, remove itself from this basis through purely formal, structural descriptions. Scientific disciplines differ in the degree to which such transformations have been accomplished. Physics, in certain areas, can be removed from its ostensive basis. Psychology has not reached such an advanced status. According to Carnap, such "de-subjectivization" will always result in formal structural descriptions. "Each scientific statement can in principle be so transformed that it is nothing but a structural statement [Carnap, 1928, p. 29]."

An Example of Structural Description

Carnap provides a simple demonstration of structural descriptions, the example of a railroad schedule. From such a record sufficient specifications

can be deduced in regard to any point (in this case, station) without going outside of the system. Our own analysis of language and meaning--we believe--represents an equally strong demonstration (see Riegel, 1970).

Contrary to common as well as to scientific conceptions, meaning is a relation (or rather a set of relations); concrete experience consists of such relations; elements and words are abstractions. Early in life and in unfamiliar situations, meaning is introduced through ostensive or, more generally, extralingual relations, i.e., by pointing toward labeled objects and qualities, or by directing or performing requested actions. These extralingual relations represent, however, exceptional circumstances for depicting the meaning of objects, events, or qualities. Regularly, such information will be substituted by intralingual relations. We will, for example, explicate the meaning of ZEBRA by saying that it "is an ANIMAL, has STRIPES, is found in AFRICA, is like a HORSE, etc." rather than by pointing at one.

Such explications presuppose that the listener has already acquired a repertoire of relational expressions so that he may insert the new information into the network available to him. This is achieved, for instance, by both relating and differentiating ZEBRA from other ANIMALS, by grouping ZEBRA into its spatial location, by recognizing the criterial attributes of ZEBRA, etc. Undoubtedly, the meaning of ZEBRA, as explicated through these relational statements, is incomplete (e.g., for zoological purposes) and subjective both in regard to the speaker and the listener. There is no assurance but, in principle, doubt that both will imply precisely the same understanding of the term. ZEBRA for one might denote a dangerous beast, for the other a handsome creature.

In spite of these idiosyncratic interpretations, communication is possible as long as, within a limited group of speakers, major sections of such a relational structure are being shared. Individuals will communicate within the boundaries of such networks by attending to subsections, such as those included in our example above. Under still more limited conditions (e.g., if only the information "ANIMAL with STRIPES" is transmitted leading in turn to multiple interpretations, such as ZEBRA, TIGER or HYENA), the need may arise to extend the subset within the relational network by including references to specific locations, i.e., AFRICA or INDIA, to types, i.e., HORSE or CAT, etc. In other words, the domain of the relational structure will vary along numerous dimensions, such as individuals (abilities, age), groups (language, sex, occupation), situations (school, job site, cocktail party), etc. Theoretically, the structure can always be extended to make a disambiguation possible. The repertoire of linguistic expressions is rich enough or can always be enriched to make identifications possible.

Our last remarks call attention to the fluctuating and shifting state of relational structures. Such conditions are characteristic, in particular, of languages. The example used by Carnap (1928, pp. 25-27), i.e., that of a railroad network, is less convincing in this regard, because it seems unreasonable to consider this structure, i.e., the system of railroad tracks, as anything but fixed. To depict this structure by activities, i.e., by the moving trains, would be unusual. Language, however, might well be regarded as a system of activities. Its underlying neuroanatomical organization is known only in its grossest features and any particular nervous impulse may reach a cortical destination simultaneously along many alternative tracks.

Moreover, neither the source nor the destination are firmly fixed. Thus, neither the tracks (relations) nor the intersections (elements) are firmly fixed. In most psychological and sociological interpretations, however, the notion of fixed structures has been given preference. Traditionally language, too, has been regarded as a system of elements (words) and connections (associations), but rarely as a system of transformed energies. Language has always been regarded as an objectified product but not as transformational labor. With this example, we are also led, once more, to our earlier contrastive comparison between the major trend in Gestalt psychology and Piaget, the former emphasizing the priority of organized structure, the latter the transformational activity.

Sociology and Anthropology

French Sociology

The contributions of the three positivists of the late 19th century have supplemented one another. Mach, in his analysis of sensory impressions, explored the foundation of the experimental psychology of Helmholz, Wundt, Külpe and Titchner. His French counterpart, Poincaré, in following the tradition initiated by the founder of positivism, Auguste Comte, emphasized the conventional and communicative basis of knowledge and thus gave main attention to sociology and linguistics. Finally, Avenarius explored the logical structure of knowledge and thereby synthesized the trends explored by Mach and Poincaré. In the present section, we elaborate further the contributions by French sociologists and anthropologists.

Because psychic processes could become an object of scientific explorations only if the objective conditions were observed which cause their

occurrence and progression, Comte, in his classification of the sciences, did not assign a separate place to psychology. The requested observations would either have to focus upon the anatomical and physiological basis of the organism or upon the conditions and development of the social milieu. During his later years Comte paid increasing attention to these sociological aspects. This tradition was continued by Poincaré and led to the foundation of the French school of sociology.

In contrast to their British counterparts who like Taylor and Fraser would insist upon the universal permanence of human traits, French sociologists, led by Dürkheim (1912), regarded psychic functions as a product of social conditions and therefore as variable. Perhaps even more important than such a sociologization of psychology, sociology became psychologized. This trend is most clearly expressed in Dürkheim's concept of "collective images" and "collective mind," both of which are psychological terms generalized to sociology. Everything social consists of images or is the product of images. Although these images cannot be reduced to physical conditions, man exists, at the same time, as a physical being. Thus, Dürkheim supports a distinct dualism: Man is both an individual physical and a communal social being. If one were to approach a study of psychology at all, it would have to consist either of psychophysiology or of psychosociology. The object for sociology, on the other hand, the collective mind, is independent of the individual and his consciousness.

Dürkheim, together with Mauss (1903), applied this conceptualization to the study of intellectual functions. Logical categories were seen as originating from social relations. The concept of space, for example, was derived

from the notion of social territory and forces. Similarly, Halbwachs (1925, 1950) analyzed the social conditions of memory by explaining that in recall we reconstruct past events by connecting them with conditions of the social life. Blondel (1928), finally, combines interpretations of the collective mind with Bergson's idea of an individualistic élan vital. In his analyses of such psychological constructs as volition, affects, and perceptions, he transcends Dürkheim's formulation. Instead of eliminating psychology in favor of biological and, especially, sociological interpretations, he proposes individual psychology as a third approach. For example, the study of perception has to be concerned with collective aspects insofar as it deals with general concepts, such as "book," "table," etc. On the other hand, it has to be concerned with neurophysiological and anatomical conditions, equally general and common to all human beings. But finally, the study of perception also has to be concerned with experiences that are unique for an individual. It is on this last issue that Blondel deviates from Dürkheim's dualistic conception and reintroduces psychology as a third form of exploration.

Blondel's deviation from Dürkheim was criticized by Halbwachs (1929) for failing to recognize sufficiently the formative role of social customs, habits, and concepts. An individual outside of society, Halbwachs maintains, would not be able to function generatively. The discrepancy between these two ways of thinking becomes most apparent in Blondel's analysis of volition. On the one hand, volition originates from biological reflexes, on the other, it represents an act which is distinctly social in nature. Although genetic connection does not exist between these two forms of volition, there exists, in between, an individual will which is psychological in nature and free.

Of course, most people do not develop such a tendency; they are solely directed by collective volition to which they subject themselves "obediently" and by their biological drives to which they submit themselves in an equally "obedient" manner. Only the intellectual "elite" is capable of developing individual volition.

Blondel's interpretations share basic features with the cultural anthropology of Levy-Brühl (1922) and, although they are nongenetic, they are similar to the cognitive developmental psychology of the early Piaget (1928). Levy-Brühl adopts from Dürkheim the concept of the collective images. But while Dürkheim postulates a "collective subject" as the carrier of these images, Levy-Brühl rejects such a metaphysical construct. For Levy-Brühl "collective images," although they are determined by the society, are conceptions of and located in the individual. Closely in line with Blondel's distinction, Levy-Brühl investigates different levels of the collective mind. He is known for his study of the "primitive mind," which he contrasts sharply with that of modern man without emphasizing--as Dürkheim did--the continuity in the development of the human race and human consciousness.

In more recent years, these different trends--as convincingly shown by Leach (1970)--merge into the functionalism of anthropologists like Malinowski (1926) and the structuralism of Levi-Strauss (1958). It is also at this juncture that one of Piaget's (1928) early contributions attains significance. Piaget tries to resolve the conflict between Dürkheim's emphasis of the continuity in the development of man and Levy-Brühl's emphasis upon qualitative differences by elaborating his famous distinction between functions and schemata. Functions remain the same throughout the stages of human

evolution and individual development; schemata change, like organs in the evolution of species, or forms of logical operations in the development of the individual. In both cases, functions and schemata complement one another; functions do not exist without schemata and schemata do not exist without functions.

In his early writings, Piaget (especially 1923, 1924) reveals the influence of the social psychology of Blondel and the anthropology of Levy-Brühl. Indeed, he succeeded in fusing the sharp dichotomy created by Dürkheim between the inner biological and the outer social nature of man. These were also the years when he contributed his interpretations of the development of language functions in terms of egocentric and socialized speech which were rebutted by Vigotsky (1962). In his later writings, Piaget abandoned his emphasis upon the impact of social conditions, however, and increasingly focused his attention upon psychic structures and functions. Thus the antithesis to the viewpoints emerging from the followers of Vigotsky grew stronger. The latter came to represent the new interpretations of Soviet psychologists.

Dialectic Psychology

Recent thinking in the Soviet Union about the philosophical foundation of the behavioral and social sciences seems to follow the viewpoints expressed by French sociologists. In regarding psychic activities as the joint outcome of inner biological and outer sociocultural conditions they too reject a central and independent role for psychology. In contrast to the reductionism of French sociologists, they do not merely split these conditions apart but emphasize interactive processes through which psychic activity and consciousness

emerge. Moreover, they consider these interactions in their temporal dependencies and thus provide dialectic interpretations. Similar to Piaget, changes in psychic activities may produce changes in inner biological conditions and these, in turn, may change psychic activities. In contrast to Piaget, however, there exist also active interventions from the outer sociocultural to the psychic conditions and vice versa.

Soviet psychology has its roots in two separate movements: The reflexology of Sechenov, Bechterev and Pavlov and the dialectic materialism of Marx, Engels and Lenin. The first foundation is sufficiently known and does not need to concern us in detail. It is, however, important to emphasize that in contrast to the behaviorists, who mechanistically split the reflex arc into its superficial external components, i.e., the stimulus and the response, Pavlov regarded the reflex as a functional unit. Only an extended conditioning history will enable the organism to separate out the stimulus from the response. In the Soviet conception, at this stage, the response becomes a <u>reaction</u> to the stimulus but, at the same time, the response <u>reflects</u> upon the stimulus. This anti-mechanistic notion became a fundamental ingredient of the Soviet interpretations and is referred to by Rubinstejn as "constitutive relationism." Interestingly enough, the same viewpoints were expressed in one of the founding articles of American functionalism, i.e., in John Dewey's (1896) treatise on the reflex arc, which, often misunderstood, was soon discarded from consideration by American psychologists.

The first foundation of Soviet psychology relates psychic activities to their inner biochemical material basis. The second foundation relates

them to their outer cultural-historical material basis. This conceptualization builds upon the historical and dialectical materialism of Marx and Engels that was injected into Soviet psychology through the posthumous publication of Lenin's (1929) philosophical notebook. The discussions emerging after this event elaborated, in particular, two notions, the dialectic interpretation of opposites and dialectic leaps.

By emphasizing the interaction between psychic and cultural-historical activities, Soviet psychologists recognized the social dependency of the former. As psychic activities emerge (and their emergence is, of course, codetermined by their interaction with biological activities), the social conditions are being changed as well. Through his own labor--as Marx stated--man transforms the conditions around him which, in turn, will change him (or at least, the generations following him). Thus, man creates himself through his own labor. For instance, by inventing a tool, by generating unique conceptual or linguistic expressions, man produces a lasting effect which "backfires" upon him and the following generations of individuals, who thus, will emerge under changed conditions. At least in regard to its psychosocial implication, the notion of dialectic interpenetration explains the superficiality of the thesis that ontogeny recapitulates phylogeny. Both sequences are bound to coincide because both are the product of human efforts.

The principle of progression by qualitative leaps is closely related to that of dialectic interpenetration. It resembles Piaget's description of cognitive development, though it emphasizes the interaction between psychic

activity and outer, material cultural-historical conditions rather than intra-psychic shifts captured by Piaget's dialectic contrast of assimilation and accommodation. As our previous examples imply, dialectic leaps are brought about by human activity. Thus, the invention of tools, of linguistic expressions, or of language in general, changes dramatically the sociocultural conditions under which human beings are growing up. Inversely, as these sociocultural conditions have come into existence during the history of mankind, they will induce upon the organism stepwise changes, each reflecting basic reorganizations of the oeprations which the individual will be able to perform, e.g., to speak, to write, to formalize, etc.

Our last statements indicate, once more, the intimate connections between functional changes produced by human activities and the structural shifts representing the products of these activities. Thus, our discussion returns to the interpretations advanced by Piaget. The interactive process of shifts is not restricted to the activities of the individual, however, but embraces all other individuals in his social world, nay, all individuals who through their ceaseless efforts over generations have created the cultural-historical conditions under which any present-day descendent grows up and, thus, lives.

During the third and most recent period in the short history of Soviet psychology, a double interaction theory has been proposed by S. L. Rubinstejn (1958, 1963; for English discussions see Payne, 1968; Riegel, 1972a,b; Wozniak, 1972). Rubinstejn's dialectic interpretation deviates from the dichotomizing attempts of French sociologists. He agrees with them, however, in assigning to psychology a secondary role. Both biology and sociology, because of the

material foundations emphasized by Soviet psychologists, rest upon more fundamental bases. Psychology is a construct and could not exist without them.

Of course, these evaluations also indicate an intrinsic strength of psychology. Psychology, more than biology and sociology, is or ought to be concerned with activities rather than with products. This conclusion, once more, returns our attention to the comparison of structure and function. Rubinstejn agrees with Piaget by emphasizing the mutual dependence of both; he disagrees with him (at least with Piaget's writings during the forties and fifties) by emphasizing that the structure-function relationship ought not to be limited to the activities of the separate individual but ought to be extended to the interactions within his cultural-historical world. He disagrees, furthermore, with Piaget by trying to trace the two interactions to their material foundations.

Concluding Remarks

In our last section, Piaget's developmental structuralism was submerged within Rubinstejn's double interaction theory. Such an interpretation seems to handle all those issues proposed in opposition to the traditional mechanistic viewpoints of American psychology, i.e., issues which focus upon the active organism in an active environment. However, in contradiction to their dialectic foundation, Soviet psychologists have emphasized the material bases of psychic processes. Thus, they have emphasized the products rather than the activities that generate them. In concluding our treatise, we will direct our attention to alternative interpretations and review, once more, the trends and options of modern psychology.

Western psychology found one of its most authentic representations in William Stern's (1935) Psychology on a Personalistic Basis which, appropriately, has been criticized by Vigotsky (1962) as individualistic and intellectualistic. Stern exemplifies a trend which derives from the British philosophy of Locke, Hume, and Berkeley (especially the latter) and continues to dominate Western thinking in the behavioral and social sciences. In extension it led, as we have seen, to the positivism of Mach, to the psychologism of Wundt, Helmholz, and Külpe and to the phenomenologism of Husserl. In spite of their wide differences, all of these scholars built their interpretations upon sensation and perception as the basis for knowledge. The world around us came to be regarded as a mere outward projection of the mind. Psychology became the most fundamental of all sciences.

While for the first group of scholars knowledge was to be gained through sensory experience and contemplations based upon them, a second school of thought, associated with the advances in the natural sciences, began to emphasize the constructive aspects of knowledge. According to Russell and Carnap, physics and astronomy, for example, represent prototypes of constructive sciences whose founding components, unlike psychological sensations, are not directly accessible to us but are intellectually generated. From this point of view, knowledge is founded upon the "sentence," in its German sense of "Satz" and "setzen." Knowledge is gained by proposing sentences rather than by receiving sensory information in a passive state.

Although related viewpoints were expressed early in psychology--for example in Brentano's Act-Psychology (1874)--they never attained an appreciation comparable to those based upon a sensory basis of knowledge. However,

philosophers have paid increasing attention to this issue as revealed in the work of Russell and Carnap as well as in such antiscientific movements as existentialism. More recently, Holzkamp (1972) has interpreted sciences in general, and psychology in particular, as an activity and, therefore, as a movement concerned with and dependent upon social conditions and historical relevance. Most influential, however, is Piaget's (1950) notion of the individual's intellectual development and of the growth of knowledge in society, of genetic epistemology, based upon the premise that progress can only occur through spontaneous, generative activities of the organism.

Finally, science and knowledge represent forms of organization and structure. Again, these organizations may either be seen as existing outside the individual recognizable through sensory experience or as generatively produced by the individual imposed upon the outside world through his interpretations. Regardless of this choice, organizational aspects have received increasing attention through the work of Avenarius, Russell, Carnap, Piaget and, finally, Rubinstejn. Because of the complexity of the structures, these theories have shown a strong tendency toward formalism, at least among the Western scholars. This trend is clearly exemplified in the progression of Piaget's research and theory. He advanced--in terms of his own theory--from an operative to a figurative psychology. His early studies of early developmental periods consist of rich but ambiguous interpretations of children's operations. Next he produced equally rich displays of imaginative, though less than fully standardized, experiments coupled with formal descriptions of the children's logic. In discussing the

highest stage of development, he provides little else than an abstract model of intellectual operations, essentially a theory on what these operations, logically, ought to be. Supportive evidence is not supplied and, apparently, not intended to be supplied. All that such evidence could consist of anyhow would be some superficial demonstrations which are neither sufficient to confirm the consistency of the theory nor to suggest important extensions.

Piaget's theory ties structuralism to the perceptionism of the earlier psychologists. Structures are confirmed by observations; structures organize experience. Soviet psychologists go beyond such a perceptionism and consider their evidence as originating from the material world outside of the observer. In contrast to earlier materialistic interpretations, they insist, however, that these conditions are not independent of the human organism; they are as much the product of human labor as they are forces impinging upon the human being. While Soviet psychologists opt for constructive theories, they abandon these theories all too soon by emphasizing the objectified material products rather than the activities by which these products are generated. Piaget, on the other hand, while emphasizing activities rather than material products, restricts himself to the developing individual under exclusion of the cultural-historical activities within which the individual grows.

A synthesizing extension would have to emphasize perception, action, and organization both in the individual and in the society. By emphasizing the products, this theory would be structural; by emphasizing the activities, it would be transformational. This theory would relate psychic activities both to their inner biological and their outer sociocultural foundations without

exclusive emphasis upon their material nature. These foundations become material if the products and structures are emphasized; they remain psychological if the activities and transformations are emphasized. Development proceeds through dialectic interactions between psychic activities and their inner biological and outer sociocultural foundations. Again, if we look at the objectified conditions, development represents, both for the individual and for the society, a sequence of temporarily stable schemata; if we look at the activities, development represents a constant flux of transformations.

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